



US005777782A

United States Patent [19]

Sheridon

[11] Patent Number: 5,777,782
[45] Date of Patent: Jul. 7, 1998

[54] **AUXILIARY OPTICS FOR A TWISTING BALL DISPLAY**

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[21] Appl. No.: 777,225

[22] Filed: **Dec. 24, 1996**

[51] Int. Cl.⁶ **G02B 26/00**

[52] U.S. Cl. **359/296; 345/107; 427/214; 349/117**

[58] Field of Search **359/298, 296; 345/107, 111; 427/214; 349/117, 188**

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[57] **ABSTRACT**

A gyrycon or rotating-particle display having an auxiliary optical structure. The display includes a substrate with an optically transmissive window, a plurality of particles disposed in the substrate, and an optical focusing element optically coupled to the window. Each particle has an anisotropy for providing an electrical dipole moment, the electrical dipole moment rendering the particle electrically responsive such that when the particle is rotatably disposed in an electric field while the electrical dipole moment of the particle is provided, the particle tends to rotate to an orientation in which the electrical dipole moment aligns with the field. A rotatable disposition of each particle is achievable while the particle is thus disposed in the substrate; when the particle is in this rotatable disposition, it is not attached to the substrate. Each particle, when rotatably disposed in the substrate, is disposable in first and second rotational orientations with respect to the optically transmissive window. Each particle provides a first optical modulation characteristic when disposed in its first orientation with respect to a flux of optical energy through the window, and further provides a second optical modulation characteristic when disposed in its second orientation with respect to a flux of optical energy through the window. The optical focusing element can be optically refractive; for example, it can include an array of converging lenses, such as a "fly's-eye" array of microlenses. In this case, the particles can be disposed in an array that is registered with the lens array.

21 Claims, 20 Drawing Sheets

